ARL-TR-8273 ● Jan 2018

US Army Research Laboratory

The Job Assessment Software System (JASS) and a Strategy for Integrating Output into the Improved Performance Research Integration Tool (IMPRINT)

by Robert Sargent, Beth Plott, and Christopher Garneau

NOTICES

Disclaimers

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Citation of manufacturer's or trade names does not constitute an official endorsement or approval of the use thereof.

Destroy this report when it is no longer needed. Do not return it to the originator.

ARL-TR-8273 ● Jan 2018

US Army Research Laboratory

The Job Assessment Software System (JASS) and a Strategy for Integrating Output into the Improved Performance Research Integration Tool (IMPRINT)

by Robert Sargent and Beth Plott
Alion Science and Technology, Boulder, CO

Christopher Garneau
Human Research and Engineering Directorate, ARL

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED (From - To)
January 2018	Technical Report	June 2016–September 2017

4. TITLE AND SUBTITLE
The Job Assessment Software System (JASS) and a Strategy for Integrating Output into the Improved Performance Research Integration Tool (IMPRINT)

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Robert Sargent, Beth Plott, and Christopher Garneau

5d. PROJECT NUMBER

5e. TASK NUMBER
2.6

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
US Army Research Laboratory
ATTN: RDRL-HRA-AA
Aberdeen Proving Ground, MD 21005-5425

8. PERFORMING ORGANIZATION REPORT NUMBER
ARL-TR-8273

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Alion Science and Technology, MA and D Division
4949 Pearl E Circle, No 100
Boulder, CO 80301

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
This report describes the history and current implementation of the Job Assessment Software System (JASS) developed by the US Army Research Laboratory. It then compares elements of JASS with the Improved Performance Research Integration Tool (IMPRINT) and makes recommendations for how the 2 tools could interact to allow analysts to conduct assessments of personnel skills and abilities with the requirements of tasks and jobs under analysis. Recommendations include adding a new average-workload-over-time report to IMPRINT, developing a file export capability in JASS, developing a JASS import capability in IMPRINT, and creating a library of JASS profiles for US military specialties.

15. SUBJECT TERMS
JASS, IMPRINT, human skills and abilities, Job Comparison and Analysis Tool, JCAT

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Christopher Garneau
Unclassified	Unclassified	Unclassified	UU	48	19b. TELEPHONE NUMBER (Include area code) 410-278-5814

Contents

List of Figures

List of Tables

1. Introduction

The Job Assessment Software System (JASS) is a computer-based survey tool used to define and measure human aptitudes required to do a job (Knapp and Tillman 1998). JASS permits evaluators to identify and rate the level of skills and abilities necessary to perform jobs and associated duties. As a test instrument, JASS provides a mechanism to elicit feedback from Soldiers and other subject matter experts (SMEs) on the relative importance of many different skills and abilities for high-level jobs and tasks performed by different specialties operating different systems. Development on the JASS software began in the early 1980s at the US Army Research Institute for the Behavioral and Social Sciences and continued at the US Army Research Laboratory (ARL) through the late 1990s. The purpose of this report is to: 1) briefly review relevant literature describing the background and development of JASS; 2) describe a recently developed web-based version of the tool; and 3) discuss a strategy and potential pitfalls for incorporating the results of JASS into analyses conducted with the Improved Performance Research Integration Tool (IMPRINT).

2. Background of JASS

In the early 1980s, the Army became increasingly interested in factoring human resource costs into overall assessments of new weapons systems. This interest came as a result of census data indicating fewer available individuals for military service, declining skills brought to the Army by new recruits, and increasing technological sophistication of the Army's new weapon systems (Rossmeisl et al. 1983). This interest continues today because of a desire to maximize overall performance for systems involving human personnel; underskilled personnel lead to the failure of a system to perform at anticipated levels, whereas overskilled personnel lead to inefficient use of human resources (Knapp and Tillman 1998).

Researchers began considering the problem in the 1970s by developing a taxonomy of aptitudes and their relationship to performance on a wide range of tasks (Fleishman 1972, 1975, 1984). Mallamad et al. (1980) extended this taxonomy by developing a branching network decision flowchart to determine whether or not each of the aptitudes is required for a job. For instance, to assess "oral comprehension," the first question would be, "In order to perform the task, is it necessary that the person know the English language?", followed by, "Is it necessary to listen to and understand spoken English sentences?" (Rossmeisl et al. 1983). In this example, answering "yes" to both would determine that "oral comprehension" aptitude is required.

This taxonomy was later incorporated into a software tool called JASS that asked subject matter experts simple "yes" or "no" questions regarding 50 aptitudes required to complete a particular duty or assignment. Table 1 shows the taxonomy used in the most recent version of JASS; a complete decision flowchart is presented in Muckler et al. (1990). The skills and abilities are partitioned into higher-level categories called "skill clusters." The 8 skill clusters currently in JASS are Communication, Conceptual, Reasoning, Speed-Loaded, Vision, Audition, Psychomotor, and Gross Motor.

Table 1 Taxonomy of skills and abilities used in JASS, divided into 8 skill clusters

Cognitive skill		**Perceptual-motor ability**	
Communication	*Conceptual*	*Vision*	*Audition*
• Oral comprehension • Written comprehension • Oral expression • Written expression	• Memorization • Problem sensitivity • Originality • Fluency of ideas • Flexibility of closure • Selective attention • Spatial orientation • Visualization	• Near vision • Far vision • Night vision • Visual color discrimination • Peripheral vision • Depth perception • Glare sensitivity	• General hearing • Auditory attention • Sound localization
Reasoning	*Speed-loaded*	*Psychomotor*	*Gross motor*
• Inductive reasoning • Category flexibility • Deductive reasoning • Information ordering • Mathematical reasoning • Number facility	• Time sharing • Speed of closure • Perceptual speed and accuracy • Reaction time • Choice reaction time	• Control precision • Rate control • Wrist-finger speed • Finger dexterity • Manual dexterity • Arm-hand steadiness • Multi-limb coordination	• Extent flexibility • Dynamic flexibility • Speed of limb movement • Gross body equilibrium • Gross body coordination • Static strength • Explosive strength • Dynamic strength • Trunk strength • Stamina

Once the software determines that a particular aptitude is required, a subjective rating scale is used by the SMEs to rate the skill level of the aptitude required for the task. The subjective rating scale ranges from 1 to 7, with 3 behavioral anchor points to guide the evaluator. Rather than being listed as low aptitude = 1, medium aptitude = 3.5, and high aptitude = 7, the numbers are associated with examples of skills that would require the appropriate level of aptitude. For instance, for "oral expression," 1 could be associated with "the ability to cancel newspaper delivery by phone," 3.5 could be associated with "giving directions to

motorists so that they can reach their destination," and 7 could be associated with "explaining difficult concepts to a class of graduate students." Each aptitude has unique examples that can be adjusted by researchers or SMEs as appropriate. These points can be altered to be specific to the task being assessed. However, in the most recent implementation of the tool, they are generalized and not specific to the task being assessed.

The first software implementation of the tool was completed in the early 1980s and was written in Applesoft BASIC for an Apple II computer (Rossmeisl 1983). In the early 1990s, a paper-and-pencil version called the Job Comparison and Analysis Tool (JCAT) was adapted to assess aptitude for military intelligence specialties (Seven et al. 1991). A few years later, a version of JASS for Windows 95 was developed using Microsoft Visual Basic. This implementation of JASS is made up of 2 discrete programs: 1) an "experimenter" component that allows a researcher to set up templates of assignments and duties and save this data to a floppy disk; and 2) a "data collection" component that uses the "experimenter" template to collect and save data in the field with SMEs assessing the assignments and duties for required aptitudes.

JASS has been used in several studies in recent years. Knapp and Tillman (1998) describe 3 applications for which JASS was tested: 1) required skills to operate the Bradley M2A3 Armored Personnel Carrier: 2) required skills for 4 home health care professional duties: and 3) required skills for 8 advanced military command and control operations. Middlebrooks et al. (1999) used JASS to evaluate skills required when driving and using a mobile phone concurrently, subsequently identifying common skills that may be at odds. Warner and Knapp (2000) investigated the skills needed for the crew of the "common ground station of the future" that provides real-time military intelligence—specifically, the goal of that study was to investigate the appropriateness the specified operator skill profile and determine if a different skill profile or different training for the specified profile were necessary for projected requirements. Sterling and Burns (2004) used JASS to determine skills required for platoon leaders in the objective force unit of action.

3. Current Web-based Implementation of JASS

ARL developed a new mobile app implementation of JASS that updates the Windows 95 version for better usability and portability by running on modern tablet hardware (Fig. 1). The new version preserves the core functionality of JASS described in the previous section but adds a more flexible interface and limited

data analysis capability. The results of JASS are also easily exportable in comma-separated-value (CSV) format for further analysis via copy and paste.

Fig. 1 Screenshot of the web-based JASS home screen

3.1 Walk-through of a JASS Evaluation

JASS allows a user to define jobs (e.g., "Driver" or "Signal Operations Specialist"), general assignments (i.e., roles), and duties. An example of the job, assignment, and duty break-down screen in JASS is shown in Fig. 2. A sample/notional evaluation for the "Operate CBM+" assignment is referenced throughout this section. CBM+ is the Computer Based Maintenance system built into the Army's Warfighter Information Network – Tactical (WIN-T) mobile C4ISR system.

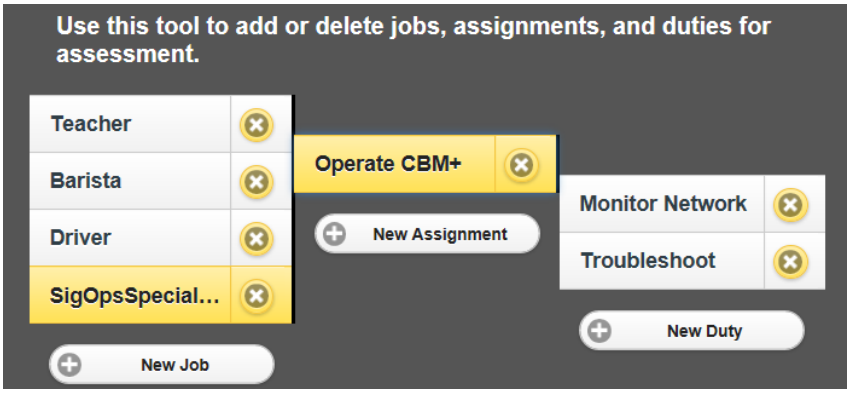

Fig. 2 Sample jobs, assignments, and duties in JASS

Evaluations are performed at the assignment level. When an analysis is performed, yes/no questions appear that relate to the various skills and abilities stored in JASS. Figure 3 illustrates the yes/no questions for the Communications skill cluster. Depending upon the answers to those questions, subsequent screens ask to rate the level of effort associated with each ability for each duty associated with the assignment being evaluated. For example, the skill rating popup for Oral Comprehension is shown in Fig. 4. A pitfall of the current implementation is that abilities cannot be designated as being not applicable to some duties and applicable to others; they can only be rated with different scores (with 1 as the lowest).

Fig. 3 Yes/no questions for the Communication skill cluster

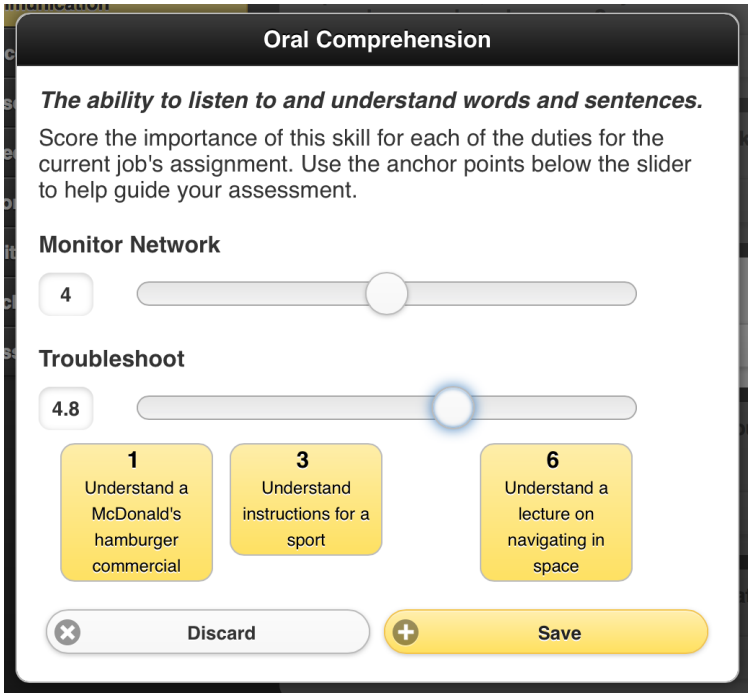

Fig. 4 Skill rating for the Oral Comprehension skill

The complete inventory of every question and skill rating anchor points in JASS is shown in the Appendix of this report. The scales for assigning different levels of each ability requirement are between 1 and 7, and there are 3 anchor points for each skill/ability that fall within this scale. The table in the Appendix is also divided into the JASS skill clusters.

The results of a JASS evaluation may either be exported in CSV format by copy and paste (Fig. 5) or analyzed within the app (Figs. 6 and 7). In the example chart shown in Fig. 6, average ratings for the duties associated with the "Operate CBM+" assignment—namely "Monitor Network" and "Troubleshoot"—are summarized from one notional evaluator (not an official SME). Note that the "Troubleshoot" duty had higher ability ratings across the board for the skill clusters, and that gross motor abilities were not applicable. Another report available after completing a JASS evaluation shows the ratings for each ability and skill cluster (Fig. 7).

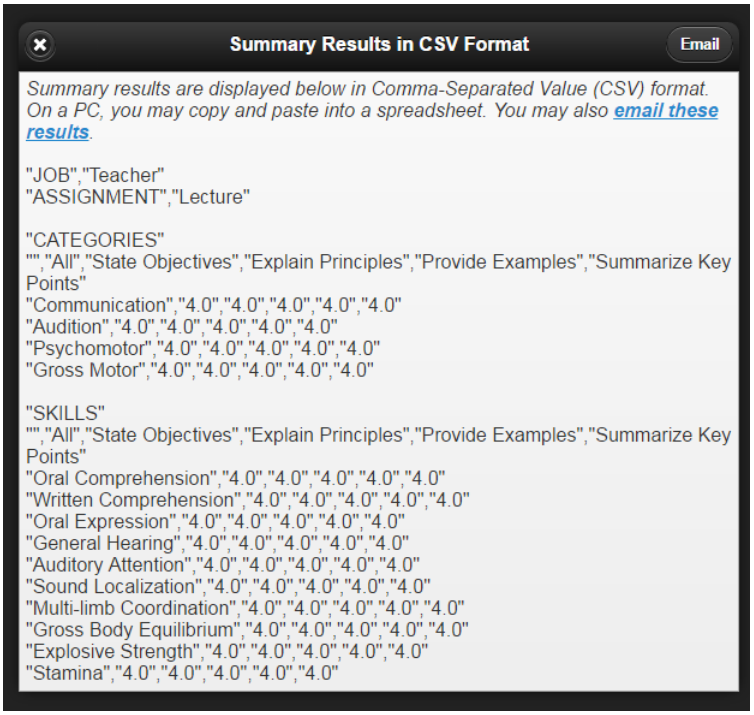

Fig. 5 JASS results in CSV Format

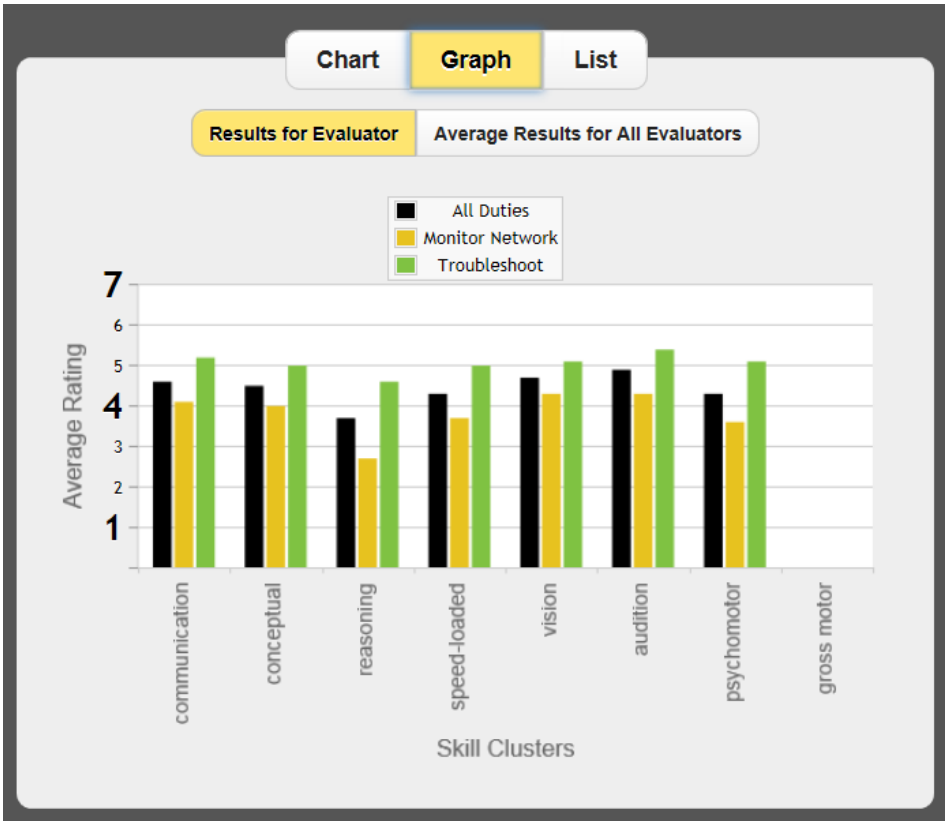

Fig. 6 JASS Skill Cluster graph

Results for Bob Sargent (2) (SigOpsSpecialist - Operate CBM+)

Categories	All	Monitor Network	Troubleshoot
Communication	4.6	4.1	5.2
Conceptual	4.5	4.0	5.0
Reasoning	3.7	2.7	4.6
Speed Loaded	4.3	3.7	5.0
Vision	4.7	4.3	5.1
Audition	4.9	4.3	5.4
Psychomotor	4.3	3.6	5.1
Skills	**All**	**Monitor Network**	**Troubleshoot**
Oral Comprehension	4.4	4.0	4.8
Written Comprehension	4.9	4.4	5.4
Oral Expression	4.7	4.0	5.4
Written Expression	4.5	4.0	5.0
Memorization	4.0	3.5	4.5
Problem sensitivity	5.3	5.0	5.5
Originality	3.8	3.0	4.5
Fluency of ideas	4.6	3.5	5.6
Flexibility of closure	4.9	4.4	5.4
Selective attention	4.8	4.8	4.8
Selective attention	4.8	4.8	4.8
Spatial Orientation	4.7	4.4	5.0
Spatial Orientation	4.7	4.4	5.0
Visualization	4.2	3.5	4.8
Inductive Reasoning	3.5	3.0	4.0
Category Flexibility	4.1	2.7	5.4
Deductive Reasoning	4.1	3.1	5.0
Information Ordering	3.9	3.0	4.8
Mathematical Reasoning	3.5	2.5	4.5
Number Facility	3.0	2.0	4.0
Time Sharing	5.0	4.5	5.5
Speed of Closure	4.2	3.2	5.2
Perceptual Speed and Accuracy	4.3	4.0	4.6
Reaction Time	4.0	3.5	4.5
Choice Reaction Time	4.1	3.2	5.0
Near Vision	5.6	5.5	5.6
Far Vision	3.8	3.0	4.5
Night Vision	4.8	4.6	5.0
Visual Color Discrimination	4.6	4.0	5.2
Peripheral Vision			
Depth Perception			
Glare Sensitivity			
General Hearing	4.3	4.0	4.6
Auditory Attention	5.4	4.5	6.3
Sound Localization			
Control Precision	4.1	2.6	5.5
Rate Control	4.2	3.0	5.4
Wrist-Finger Speed	4.8	4.0	5.5
Finger Dexterity	4.6	4.3	4.9
Manual Dexterity			
Manual Dexterity			
Arm-Hand Steadiness	4.0	4.0	4.0
Multi-limb Coordination			

Fig. 7 JASS tabular results

3.2 Opportunities for Improvement of the Current Implementation

Throughout the process of using JASS to notionally rate abilities for the CBM+, a few questions and possible ideas for improvements surfaced. First, it is not possible to completely rule out some abilities for one duty but not for another one beneath the same assignment (as mentioned in the previous section). Second, there is not any guidance on what exactly is being rated in terms of applicability to performing what are generally higher-level functions or tasks (the assignments and duties). In other words, does the rating assume a notional average level of effort over the course of a mission, procedure, function, or set of tasks? Or rather the perceived maximum ability required at any time during the use of the system? Third, there is not any way to provide any sort of time-weighted element to the ratings. That is, there is no way to specify that "my rating is a maximum ability required but the job will only experience this level of effort for short periods of time."

A way to mitigate some of these issues would be to break an assignment down into very detailed tasks (i.e., make the duties very detailed tasks). However, given the level of effort associated with evaluating each duty, this would quickly become time prohibitive.

When tabulating results, it became apparent that ruling out some abilities from an assignment by answering "no" to some of the questions meant that the null value of that particular sub-ability is not taken into account when average scores for skill clusters are calculated. In other words, in the sample results shown in Fig. 7, 3 of the abilities beneath vision were ruled out of the analysis. However, the average score for the Vision skill cluster is for the 4 scores evaluated, not taking into account that some sub-abilities were not applicable.

In spite of some of the issues noted in this section, JASS has substantial utility for evaluating abilities necessary to perform jobs, assignments, and duties. It is a structured methodology, inclusive of questions and benchmarks, which allows different expert evaluators to pick apart duties and eventually determine the basic skill clusters that are most needed to perform them.

4. A Strategy for Integrating Output of JASS with IMPRINT

This section discusses how JASS and the Improved Performance Research Integration Tool (IMPRINT) could be used together to address personnel capability concerns.

4.1 Comparison of JASS with Elements of IMPRINT

IMPRINT relies on a detailed task analysis as the basis for studying systems and human performance on missions associated with those systems (Mitchell and Samms 2010; Samms 2010). IMPRINT includes predefined personnel definitions, such as Army Military Occupational Specialties (MOS), that can be assigned to Warfighters performing tasks in a mission of interest. Warfighters assigned to tasks are also called "operators."

At the highest level, IMPRINT specialties and/or operators will usually equate to jobs in JASS. Matching IMPRINT levels of analysis to the next levels of JASS evaluations, however, is not nearly as clear-cut. As mentioned previously, IMPRINT relies on very detailed levels of task analysis. An example of an IMPRINT subnetwork of tasks for CBM+ operations is shown in Fig. 8. Whereas a reasonable breakdown in JASS may go as far as "Troubleshoot" and "Monitor" as duties beneath an assignment, an IMPRINT analyst must eventually break those duties down to detailed tasks such as making a specific observation on a screen, choosing an option from a menu, or typing in needed information. All of the detailed information entered into an IMPRINT model that makes it represent predicted human performance, such as times, probability of success, consequences of failure, workload, and decision logic, is entered at the task level.

Fig. 8 IMPRINT task network example

Although assignments in JASS may equate to functions (groups of tasks representing a subset or phase of a mission) in IMPRINT, they may also equate to missions (an entire task network representing the human performance study being performed). Also, although duties in JASS are also sometimes called "tasks," they really only equate to functions, not detailed tasks, in IMPRINT. These uneven correlations need to be considered when determining how to best utilize JASS to complement or enhance the functionality of IMPRINT in some way.

4.2 Points of Integration for JASS Results in an IMPRINT Analysis

There are 2 possible "hooks" for linking the skill clusters and abilities in JASS with IMPRINT—namely, task taxons and mental workload resource channels. For both of these potential hooks, it is necessary to shift to the 8 JASS skill clusters, as nothing in IMPRINT is as detailed as the individual skills/abilities in JASS. Each potential IMPRINT hook will be discussed briefly here and mapped to JASS skill clusters.

Task taxons in IMPRINT are descriptors of the high-level abilities required to perform each detailed task. Taxons exist in IMPRINT primarily as hooks for performance moderators, such as environmental stressors, as most moderator algorithms are anchored against task taxons (for example, if a Warfighter is wearing a high level of encumbering protective gear, it is intuitive that fine motor tasks will be more difficult to perform). The 9 IMPRINT taxons that can be used to describe every task in an IMPRINT human performance model are shown in Table 2.

Table 2 IMPRINT taxons

The Nine IMPRINT Taxons, Their Descriptions, and Task Examples (Allender, Salvi et al., 1997)		
Taxons	**Definitions**	**Examples**
Visual	Requires using the eyes to identify or separate targets or objects	• Seeing something move and then recognizing it as an enemy tank
Cognitive - Numerical	Requires processing arithmetical or mathematical calculations	• Measuring an azimuth on a map with a protractor • Estimating the distance between two points on a map
Cognitive - Information Processing/Problem Solving	Requires processing information mentally and reaching a conclusion	• Locating a fault in an electrical system after troubleshooting • Selecting the best firing position for a machine gun
Fine Motor Discrete	Requires performing a set of distinct actions in a predetermined sequence mainly involving movement of the hands, arms or feet with little physical effort	• Assembly and disassembly of the M-16 rifle • Starting the engine of a truck
Fine Motor Continuous	Requires expending extensive physical effort or exertion to perform an action	• Driving a vehicle • Tracking a moving target
Gross Motor Heavy	Requires expending extensive physical effort or exertion to perform an action	• Lifting an artillery round • Loosening a very tight bolt with a wrench
Gross Motor Light	Requires moving the entire body (i.e., not just the hands) to perform an action without expending extensive physical effort	• Getting into a prone firing position • Evacuating a tank
Communication (Read and Write)	Requires either reading text or numbers that are written somewhere or writing text or numbers that can be read	• Reading a preventive maintenance checklist for a vehicle • Writing a letter home
Communication (Oral)	Requires either talking or listening to another person	• Giving a situation report by radio • Receiving a password from someone while on guard duty

Some tasks are a combination of more than one of the taxons, such as a task to monitor the environment that has both a visual and cognitive component. When a stressor is applied to a human performance model in IMPRINT, only tasks that have some component upon which the stressor algorithm applies are impacted. It is also important to note here that task taxons describe the make-up of a task but do not have any "demand" component. For example, 2 tasks could be both 100% "cognitive – information processing," but one could be easy and one could be difficult.

Based on a detailed analysis of JASS and the abilities contained in each skill cluster, and knowledge of the IMPRINT task taxons, Table 3 suggests a mapping of the JASS skill clusters to IMPRINT task taxons.

Table 3 Mapping of JASS skill clusters to IMPRINT taxons

JASS skill cluster	Relevant IMPRINT task taxons
Communication	Communication (read and write) communication (oral)
Conceptual	Cognitive – information processing
Reasoning	Cognitive – numerical
Speed-loaded	Cognitive – information processing
Vision	Visual
Audition	Communication – oral
Psychomotor	Fine motor discrete Fine motor continuous
Gross motor	Gross motor heavy Gross motor light

Additionally, IMPRINT includes a built-in capacity to perform detailed mental workload analyses using Multiple Resource Theory (MRT) for in-depth mental workload studies of specific operational missions broken down into detailed tasks. IMPRINT allows an analyst to study workload using a very sophisticated task-level approach and MRT. With this approach, workload is broken down into resource/interface channels, with resources being mental capacities to handle different types of workload (such as visual, auditory, speech, fine motor, and cognitive) and interfaces being devices (such as a control panel or set of display screens) being studied in more detail. An analyst then assigns workload demands in each applicable resource/interface channel to each of the operator-performed tasks in their detailed operational mission task networks.

Unlike task taxons, IMPRINT mental workload scores assigned to tasks for different resource channels do have demand values similar to ability demands determined using the JASS tool. Also similar to JASS, when an analyst assigns workload demand values to a task in each of the default resource channels, benchmarks are available to help guide their assignment and the scores for each

individual resource channel assignment are generally between 1 and 7. The 7 default workload resource channels in IMPRINT are Visual, Auditory, Cognitive, Fine Motor, Speech, Gross Motor, and Tactile. None of the JASS skill clusters map to the tactile workload resource channel. For the other skill clusters, Table 4 suggests a JASS skill cluster relevant to each IMPRINT workload resource channel.

Table 4 Mapping of JASS clusters to IMPRINT channels

JASS skill cluster	Relevant IMPRINT workload resource channels
Communication	Speech
	A specific score for visual (5.1, read)
	Two specific scores for auditory (3.0 and 6.0, interpret different levels of speech)
Conceptual	Cognitive
Reasoning	Cognitive
Speed-loaded	Cognitive
Vision	Visual
Audition	Auditory
Psychomotor	Fine motor
Gross motor	Gross motor

4.3 Future Work: Recommended Ways Forward

Several different options were considered for using results of JASS studies to enhance IMPRINT and/or comparing results of IMPRINT analyses to JASS results to determine personnel fits. It was first determined that the results of a JASS analysis could not be used to modify task performance in IMPRINT models for several reasons. First, the JASS analysis is performed at a much higher level than an IMPRINT analysis, and the results could not be generalized to IMPRINT tasks. Also, JASS does not collect any performance data that would feed IMPRINT algorithms to modify task times and/or task accuracy measures.

While results of a JASS analysis could not be used to directly modify task performance in IMPRINT models, notionally, if there were an available library of JASS analyses that were performed for different specialties (such as MOS for the Army), procedures and tasks that were not good fits for personnel based on their high-level aptitudes mapped against IMPRINT taxon requirements could be flagged. For example, if a JASS analysis determines that a certain MOS usually does not require too much reasoning capability (low scores or not applicable), but a series of IMPRINT tasks in a mission are largely "cognitive – numerical" in taxon type, this could be flagged as a possible personnel mismatch. However, one

problem with this is that taxons do not contain demand information. So if it was further determined that the largely "cognitive – numerical" tasks were simple, this flag could be ignored.

Because of the lack of a demand component in the IMPRINT task taxons, it was determined that the IMPRINT workload resource channel scores would be a better metric to relate to JASS skill clusters. To capture something more useful than just an IMPRINT task-by-task analysis to high-level JASS evaluation, however, it is proposed that an existing IMPRINT workload report be modified to include time-averaged workload scores for the different resource channels. While this approach would not capture relevant critical skills required for very brief periods (e.g., medic bandaging a wound during an emergency), it would provide a rough indication of the kinds of skills required for the job/tasks being modeled in IMPRINT. Figure 9 shows a new report prototyped in Excel based on an existing IMPRINT workload summary report for a signal operations specialist performing CBM+ activity within a more general mission.

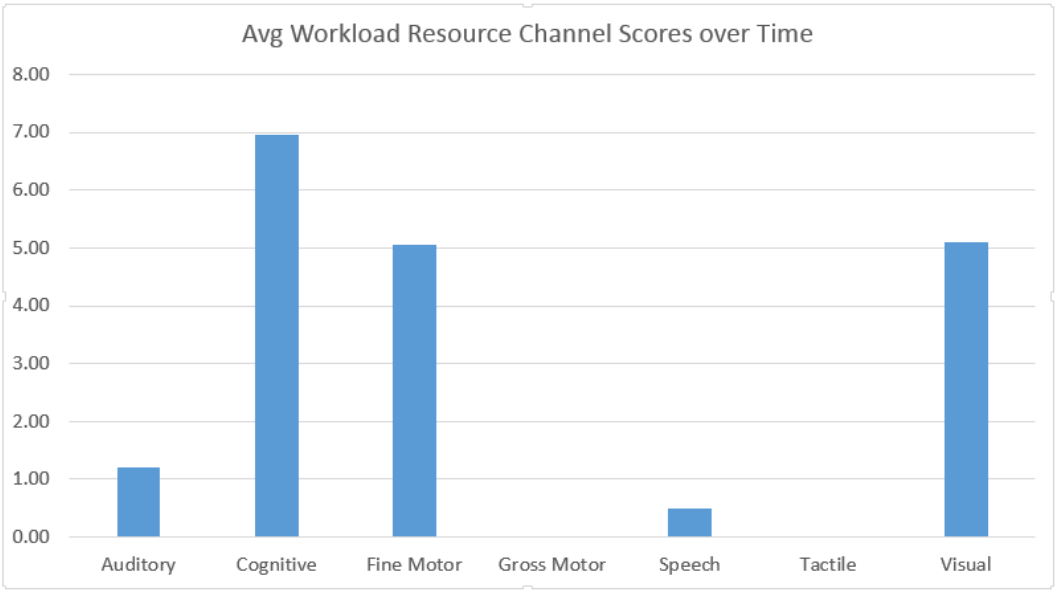

Fig. 9 Example report showing the average workload over the period of time modeled

For this particular example, the report indicates that the operator needs high abilities in the IMPRINT cognitive, fine motor, and visual workload resources. These could then be compared against associated JASS skill clusters to make sure that the personnel assigned to the modeled work are a good fit. Using the mapping of JASS skill clusters to IMPRINT workload resources from the previous section of this report, but ignoring the specific scores in the Visual and Auditory channels that represent communication (they could not be teased out in the workload

average over time report), the comparison report in Fig. 10 was generated. In order to generate a comparison report similar to what is shown in the figure, JASS would need to include an automatic export capability (e.g., generation of a CSV file) to provide the ability for IMPRINT to import and then display a skill profile.

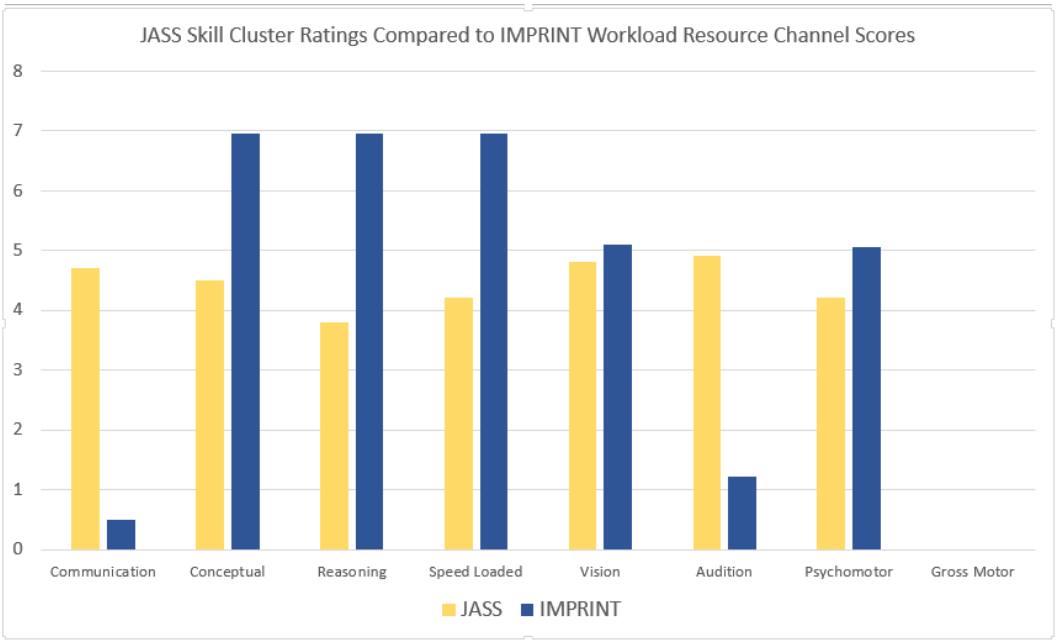

Fig. 10 JASS skill cluster ratings compared to IMPRINT workload scores

According to this report, the IMPRINT model predicts that the operator will need higher levels of cognitive ability (equating to conceptual, reasoning, and speed loaded in JASS) than the JASS evaluation shows, but lower levels of communication (speech) and audition. This does point to a drawback in being able to compare the 2 evaluations in that not all communication tasks can easily be captured by workload scores in IMPRINT. It could be that the operator is being asked to read and type communication, but that those activities are being captured in the visual and psychomotor workload resource channel scores in IMPRINT.

Another possible enhancement to IMPRINT—and JASS—would be to add a library of skill and ability profiles by specialty (e.g., MOS for Army/Marines, rating for Navy, Air Force Specialty Code for Air Force). Having a library of specialties would allow IMPRINT to automatically generate the comparison report for Warfighters that have been assigned specialties included in the base IMPRINT tool. A user could also browse the skill and abilities profiles for any included specialty if desired. An example of viewing skills and abilities for a Navy rating is shown in Fig. 11.

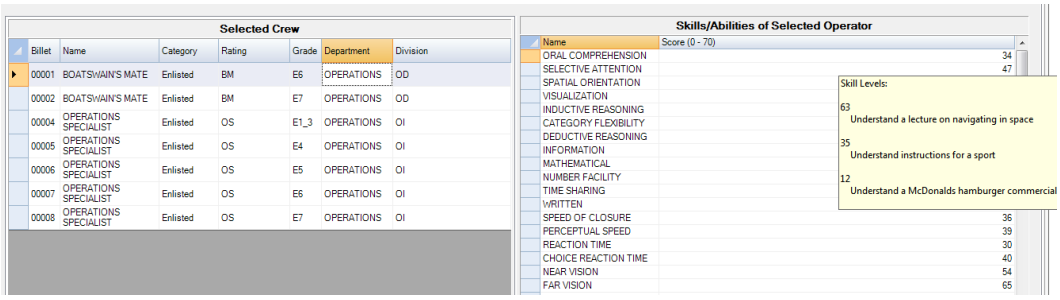

Fig. 11 Viewing skills for Navy rank and rating

To facilitate incorporation of the baseline skills/abilities data, Navy JASS profiles could be imported from the Integrated Simulation Manpower Analysis Tool developed by Alion for the Naval Surface Warfare Center Dahlgren Division. SMEs and Department of Defense or civilian occupational documents could possibly be used to generate initial data for those specialties where data do not already exist.

5. Conclusion

This report has described the JASS tool, compared elements of JASS with elements of IMPRINT, and made recommendations for how the 2 tools could interact in order to allow analysts to conduct assessment of personnel skills and abilities with the requirements of tasks and jobs under analysis. Specific modifications were proposed to enhance JASS and IMPRINT and allow them to work together. Future work will perform these modifications.

6. References

Fleishman EA. On the relation between abilities and human performance. American Psychologist. 1972;27:1017–1032.

Fleishman EA. Toward a taxonomy of human performance. American Psychologist. 1975;30:1127–1147.

Fleishman E, Quaintance M. Taxonomies of human performance: the description of human tasks. Orlando (FL): Academic Press; 1984.

Knapp B, Tillman B. Job skill assessment of software system. Proceedings of the Human Factors and Ergonomics Society 42nd Annual Meeting; 1998; p. 1319—1321

Mallamad SM, Levine JM, Fleishman EA. Identifying ability requirements by decision flow diagrams. Human Factors. 1980;22:57–68.

Middlebrooks S, Knapp B, Tillmann B. An evaluation of skills and abilities required in the simultaneous performance of using a mobile telephone and driving an automobile. Aberdeen Proving Ground (MD): Army Research Laboratory (US); 1999. Report No.: ARL-TR-1995.

Mitchell DK, Samms CL. An analytical approach for predicting Soldier workload and performance using human performance modeling. In: Barnes, Jentsch, editors. Human-robot interactions in future military operations. London (UK): Ashgate Publishing; 2010.

Muckler F, Seven S, Akman A. Proposed method for military intelligence job ability assessment. Alexandria (VA): Army Research Institute for the Behavioral and Social Sciences (US); 1990. Research Note No.: 90-135.

Rossmeissl PG, Tillman BW, Rigg KE, Best PR. Job assessment software system (JASS) for analysis of weapon systems personnel requirements. Alexandria (VA): Army Research Institute for the Behavioral and Social Sciences (US); 1983. Research Report No.: 1355.

Samms C. Improved performance research integration tool (IMPRINT): human performance modeling for improved system design. Human Factors and Ergonomics Society 54th Annual Meeting Proceedings; 2010.

Seven S, Akman A, Muckler F, Knapp B, Burnstein D. Development and application of a military intelligence (MI) job comparison and analysis tool (JCAT). Alexandria (VA): Army Research Institute for the Behavioral and Social Sciences (US); 1991. Research Note No.: 91-41.

Sterling B, Burns C. Skills required for platoon leaders in the objective force unit of action. Aberdeen Proving Ground (MD): Army Research Laboratory (US); 2004. Report No.: ARL-TN-0215.

Warner J, Knapp B. Crew characteristics for common ground station applications. Aberdeen Proving Ground (MD): Army Research Laboratory (US); 2000. Report No.: ARL-TN-162.

INTENTIONALLY LEFT BLANK.

Appendix. Job Assessment Software System (JASS) Skill Clusters, Abilities, Questions, and Rating Scale Benchmarks

	Ability	Question	Rating Scale Benchmarks		
Communication		To perform the task, is it necessary that the person know and use language?			
	Oral Comprehension	Is it necessary to listen to and understand spoken words and sentences?	**1** Understand a McDonald's hamburger commercial	**3** Understand instructions for a sport	**6** Understand a lecture on navigating in space
	Written Comprehension	Is it necessary to read and understand written words, sentences, and paragraphs?	**1** Read the words on a road map	**4.2** Understand an apartment lease	**6.5** Understand an instruction book on repairing a missile instrument system
		Assuming that the person is knowledgeable about a subject or topic, must he communicate that knowledge to others?			
	Oral Expression	Must he communicate through speaking so that others will understand his information?	**1** Cancel newspaper delivery by phone	**3.5** Give directions to a motorist so that he can reach his destination	**6.2** Give a technical talk, using new concepts, on a technical subject before a professional society
	Written Expression	Must he communicate through writing so that others will understand his information?	**1** Write a note to remind someone to take something out of the freezer	**3.5** Write a job recommendation for a subordinate	**6.5** Write an instruction book for computer systems
Co	Memorization	Must the person be able to remember or memorize words, numbers, pictures,	**1** Remember the number on	**2.5** Memorize the pledge to	**6** Memorize the Gettysburg

	Ability	Question	Rating Scale Benchmarks		
		procedures, or other things?	your bus so that you get back on the right one	the flag	address after studying it for 15 minutes
		Can problems, mistakes, or malfunctions occur in this task or as a part of the task? (e.g., machine isn't operating correctly)			
Conceptual	Problem Sensitivity	Is it important that these problems are recognized by the person performing the task? (e.g., seamstress notices machine stitches are too tight; teacher recognizes child has a hearing problem; proofreader finds typing errors)	**1** Recognize that an unplugged lamp won't work	**3.5** Recognize from the mood of prisoners that a riot is about to occur	**5.5** Recognize an illness at an early stage when there are only a few symptoms
	Originality	Does the task require the person to be creative? (e.g., develop new procedures where standard procedures are not applicable or not working well; produce unusual and clever ideas on a topic or situation; create novel solutions to problems)	**2** Use a credit card to open a locked door	**4.5** Make jobs more interesting for subordinates	**6.2** Invent a new synthetic fiber
	Fluency of Ideas	Is it necessary for the person to produce a number of ideas about a given topic, regardless or quality, to perform the task satisfactorily? (e.g., name four brands of toothpaste; think of as many names as possible for a new	**1.6** Name four brands of toothpaste	**3.2** Think of as many ideas as possible for the name of a new organization	**6.5** Name all possible problems that might occur with a space launch

	Ability	Question	Rating Scale Benchmarks		
		organization; name all the possible problems which might occur with a space launch)			
		Are distracting stimuli present along with information relevant to the task?			
	Flexibility of Closure	Does the person know what he is looking for? (e.g., find a steak knife in a utensil drawer; look for a golf ball in the rough; receive Morse code in the presence of background noise)	**1.5** Find a steak knife in a utensil drawer	**4** Look for a golf ball in the rough	**6** Receive high speed Morse code in presence of similar background signals

	Ability	Question	Rating Scale Benchmarks		
Conceptual	Selective Attention	Must the person ignore distractions which are not part of the actual task? (e.g., study for an exam in a house of noisy children; listen to the news while a dinner conversation is taking place)	**2.5** Have a conversation with a friend at a noisy cocktail party	**4.2** Listen to a news broadcast during a dinner conversation	**5.5** Study for a math exam in a house of noisy, young children
	Selective Attention	Is it necessary that the person concentrate on a boring task?	**2.5** Have a conversation with a friend at a noisy cocktail party	**4.2** Listen to a news broadcast during a dinner conversation	**5.5** Study for a math exam in a house of noisy, young children
		Is information about location important in the performance of the task?			
	Spatial Orientation	Should the person know his location in relation to the location of objects? (e.g., locate his position on a road map)	**2.5** Find your way through a familiar room when lights are out without bumping into anything	**4** While lost in a rural area, locate your position on a road map	**5.5** Be aware of your orientation upon awakening in a gravity-free environment, like a spacecraft
	Spatial Orientation	Should the person know the location of objects in relation to his own location? (e.g., find his way through a dark room without bumping into anything)	**2.5** Find your way through a familiar room when lights are out without bumping into anything	**4** While lost in a rural area, locate your position on a road map	**5.5** Be aware of your orientation upon awakening in a gravity-free environment, like a spacecraft
	Visualization	Does the task require that the person be able to form mental images of how something will look after it is moved around or its parts have been re-	**1** Imagine how to put paper in the typewriter so the letterhead comes out at the	**4** Know how to cut and fold a piece of paper to make a	**6** Imagine your opponent's as well as your own moves in a

	Ability	Question	Rating Scale Benchmarks		
		arranged? (e.g., imagine how to put paper in a typewriter so letterhead comes out on top; imagine how to cut and fold a piece of paper to make a cube)	top	cube	chess game
Reasoning		To perform the task, must the person generate rules or principles?			
	Inductive Reasoning	Must these rules explain diverse pieces of information? (e.g., diagnose a disease using results from many lab tests, decide which student characteristics are related to future success, decide on the best way to organize the office filing system)	**2** Order a seafood platter at a restaurant to determine whether or not you like seafood	**3.5** Interpret a weather chart	**5** Diagnose a disease utilizing knowledge from many lab tests
	Category Flexibility	Must these rules tell how to group a set of things in different ways? (e.g., generate a number of ways to sort nails--length, metal, etc.; invent rules for classifying flowers--size, color, scent, uses, etc.; construct classification systems for synthetic fibers--cost, strength, elasticity, melting point, etc.)	**1.7** Generate a number of ways to sort nails (length, metal, size, etc.)	**3.2** Invent rules for classifying flowers (size, color, odor, uses, etc.)	**6** Construct classification systems for synthetic fibers (strength, cost, elasticity, etc.)
		Must the person apply existing rules or principles?			
	Deductive	Are the rules applied to specific cases to	**1.6**	**5**	**6.4**

	Ability	Question	Rating Scale Benchmarks		
	Reasoning	arrive at logical answers? (e.g., know you can coast down a hill due to gravity when you've run out of gas, use laws of economics in selecting stocks, design an aircraft wing using the principles of aerodynamics)	Know that you can coast down a hill due to the law of gravity when you've run out of gas	Use laws of economics in selecting stocks	Design an aircraft wing using principles of aerodynamics
	Information Ordering	Are the rules used to order or arrange things in a specified way? (e.g., put invoices in numerical order, arrange sentences into a paragraph that makes sense)	**1.5** Put things in numerical order	**3** Arrange five sentences into a paragraph that makes sense	**6.5** Determine the appropriate sequence of checkout procedures for the Challenger space shuttle
Reasoning		Does the task involve any mathematical or numerical concepts?			
	Mathematical Reasoning	Must the person understand or organize a problem using mathematical concepts? Actual calculations and computations are not required. (e.g., set up a problem to determine how much 10 oranges will cost when they are 2 for 29 cents; decide how to calculate profits to determine size of Christmas bonuses; determine mathematics for simulating a lunar approach and landing)	**1.5** Decide how to compute what 10 oranges will cost when they are 2 for $0.29	**4.2** Decide how to calculate profits to determine size of Christmas bonuses	**6.8** Determine mathematics for simulating a lunar approach and landing
	Number Facility	Does the task require that the person perform mathematical calculations,	**1** Add 2 and 7	**2.6** Reconcile checking	**5** Compute interest payments

	Ability	Question	Rating Scale Benchmarks		
		such as adding, subtracting, multiplying, or dividing? (e.g., add 2 and 7, balance checking account with monthly statement, compute interest payment from investments)		account monthly statement	that should be generated from investments

	Ability	Question	Rating Scale Benchmarks		
Speed-Loaded		Does the information which must be used in the task come from two or more sources? (examples of two or more sources are drive a car, play an instrument in a conducted orchestra; examples of one source are read a newspaper, talk on the phone, watch television)			
	Time Sharing	Must the person switch back and forth between the two or more sources of information relevant to the task? (e.g., listen to 2 conversations at once; watch street signs and the road while driving 30 mph; monitor several TV channels at the same time; monitor inbound and outbound planes on a radar scope during a period of heavy traffic)	**3** Watch street signs and the road while driving 30 mph	**4.5** Monitor several TV channels at the same time	**6** Keep track of all inbound and outbound planes during a period of heavy traffic
		Must the person quickly structure information into a meaningful pattern? (e.g., recognize and old song after hearing only the first few notes; recognize weather patterns on a radar scope)			

	Ability	Question	Rating Scale Benchmarks		
	Speed of Closure	Is the pattern unpredictable?	**2.2** While listening to the radio, recognize and start to hum an old song after hearing only the first few lines	**4.2** Find five camouflaged birds in a picture	**5.2** Interpret patterns on weather radar to decide if weather is changing
Speed-Loaded		Must things, present or remembered, be compared with other things? (e.g., scan list of batting records to see who scored the most runs; read 5 temperature gauges in 30 seconds to insure safe operation; inspect electrical components for defects; recognize a lost glove)			
	Perceptual Speed and Accuracy	Must the comparisons be made quickly and accurately?	**2.2** Quickly scan list of batting records in Sunday sports section to see who scored the most runs	**4** Read 5 temperature gauges in 30 seconds to insure temperature is within safe limits	**5.2** Inspect assembled electrical components for defects as they flow by on a fast moving line
		Is it necessary for the person to initiate one response very quickly? (e.g., apply the brakes when light turns red; return the ball in a ping pong game; duck to miss being hit by a snowball)			

	Ability	Question	Rating Scale Benchmarks		
	Reaction Time	Does the task involve only one response initiated to one signal?	**2** Start to apply brakes on your car 1 second after the light turns red	**3.2** Duck to miss being hit by a snowball thrown from across the street	**5.2** Hit back the ball which has been slammed at you in a ping-pong game
	Choice Reaction Time	Must the person quickly choose between actions in response to two or more signals? (e.g., when doorbell and phone ring, select one to answer first; in and out-of-control spacecraft, pick 1 of 5 possible fixes)	**2.2** When a doorbell and telephone ring simultaneously, select one to answer first in one second	**4** Operate a busy switchboard where you must switch calls in and out quickly and accurately every few seconds	**6.2** In a spacecraft out of control, choose one of 5 possible corrections in 0.7 seconds

	Ability	Question	Rating Scale Benchmarks		
Vision		To perform the task, is it necessary to be able to see things in the environmental surroundings?			
	Near Vision	Are the things that must be seen nearby?	**1.5** Plug in a TV set	**4.5** Cut and mount color film transparencies	**6** Read the fine print of legal journals
	Far Vision	Are the things that must be seen at a distance?	**1.5** Point out a mountain range in the distance	**4.5** Drive a moving van across the country	**6.5** Detect differences in ocean vehicles on the horizon
	Night Vision	Must things be seen under low light conditions?	**1.5** Find and turn on a light in a dim room	**4.2** Take notes during a slide presentation	**5.5** Catch lightning bugs on a summer evening
	Visual Color Discrimination	Does the task require the capacity to match colors or to discriminate between colors?	**1.5** Sort soiled sheets and linens before washing	**3.5** Match wood grains in a lumber yard	**6** Paint a portrait from a living subject
	Peripheral Vision	Is it necessary to perceive objects or movement toward the edge of the visual field? (e.g., monitor an opponent's position while returning a tennis serve; monitor the instrument panel of a jet plane)	**1.8** While driving, see cars approaching from left or right	**3.6** Monitor opponent's position while returning tennis serve	**4.5** Monitor the instrument panel of a jet aircraft
	Depth Perception	Is it necessary to be able to tell which of several objects is farther away, or to judge how far an object is from the	**2.8** Judge which of two distant	**4.2** Operate a construction	**5.5** Thread a needle

	Ability	Question	Rating Scale Benchmarks		
		observer? (e.g., judge which of two distant buildings is closer; thread a needle)	buildings is closer	crane	
	Glare Sensitivity	Is it necessary to see objects in the presence of glare or bright ambient lighting? (e.g., see boats on the horizon when sailing; snow ski in bright sunlight)	**1.5** View pictures printed on high gloss paper	**4.5** See boats on the horizon while sailing	**6** Snow ski in bright sunlight

	Ability	Question	Rating Scale Benchmarks		
Audition	General Hearing	Is it necessary to detect and to discriminate among sounds that vary over broad ranges of pitch and/or loudness? (e.g., notice the carriage return bell while typing; monitor electronic equipment at a nurse's station)	**1.8** Notice the carriage return bell while typing	**3.8** Monitor audio alarms on electronic equipment at a nurse's station	**6** Identify a bird species by its call
		Is it necessary to focus on a single source of auditory information?			
	Auditory Attention	Are other distractions or irrelevant auditory stimuli present?	**1.4** Locate someone calling you from across a city street	**4.5** Listen for a flight announcement at an airport	**5.8** Receive Morse code in a noisy radio room
	Sound Localization	Must the direction from which auditory stimuli originate be identified? (e.g., find a ringing telephone in an unfamiliar apartment; locate someone calling your name in the midst of a crowd)	**1.5** Find your ringing alarm clock	**3.2** Find a ringing telephone in an unfamiliar apartment	**5** Locate someone calling your name in the midst of a crowd
Psychomotor		Does the task require the adjustment of controls of a machine or vehicle?			
	Control Precision	Must the controls be adjusted quickly and repeatedly to exact positions? (e.g., manipulate farm tractor controls; work sound equipment for a band; drill a	**1.5** Throw a light switch	**3.5** Manipulate farm tractor controls	**6** Drill a tooth

	Ability	Question	Rating Scale Benchmarks		
		tooth)			
		Must the controls be adjusted to changes in speed or direction of a continuously moving object or scene? (e.g., ride a bike along side a runner; shoot a duck in flight; operate controls to land a jet on an aircraft carrier in turbulent water)			
Psychomotor	Rate Control	Are the speed and direction of the object or scene unpredictable?	**1.8** Ride a bicycle alongside a runner	**3.4** Keep up with the car ahead where its speed may vary	**6.5** Operate aircraft controls to land a jet on an aircraft carrier in turbulent weather
		Must the person make repeated hand, finger, or wrist movements?			
	Wrist-Finger Speed	Is it important that these movements be fast? (e.g., use a pencil sharpener; scramble eggs; send Morse code using a telegraph key)	**1.8** Use a pencil sharpener	**3** Scramble eggs with a fork	**5** Key a telegraph at 25 words per minute
		Do these movements require skillful or coordinated action?			
	Finger Dexterity	Using the fingers? (e.g., untie a knot on a package; play a guitar; knit)	**1.5** Put coins in a parking meter	**3.4** Untie a knot in a long-awaited package	**5.5** Play a classical flamenco piece on the guitar

	Ability	Question	Rating Scale Benchmarks		
	Manual Dexterity	Using one or both hands together? (e.g., fold laundry; crate oranges; juggle 3 balls)	**2.5** Tie a necktie	**4** Package oranges in crates as rapidly as possible	**6.8** Perform open-heart surgery
	Manual Dexterity	Using one hand in conjunction with its arm? (e.g., toss a basketball; use a hammer)	**2.5** Tie a necktie	**4** Package oranges in crates as rapidly as possible	**6.8** Perform open-heart surgery
	Arm-Hand Steadiness	Is it important that the arm and hand be steady? (e.g., light a cigarette; thread a needle; aim a bow and arrow)	**1.8** Light a cigarette	**4.5** Thread a needle	**6.4** Cut facets in diamonds
	Multi-Limb Coordination	Does the task require the movement of 2 or more limbs together in a coordinated action while the body doesn't move because the person is sitting, standing, or lying down? (e.g., operate sewing machine with a foot treadle)	**2.5** Operate a sewing machine with a foot treadle	**4** Operate a fork lift in a warehouse	**5.8** Play drums in a jazz band
Gross Motor	Extent Flexibility	Does the task require the person to be flexible--i.e., able to bend, stretch, twist, or reach out with the body, arms, or legs? (e.g., reach for a soda in the back of the refrigerator; touch toes; do splits; win a limbo championship)	**1.8** Reach for a soda in the back of the refrigerator	**3.4** Reach out for something on the top shelf	**6** Win a limbo championship

	Ability	Question	Rating Scale Benchmarks		
	Dynamic Flexibility	Must the flexible movements be made quickly and repeatedly? (e.g., fill a bag with shells at the seashore; shovel coal into a furnace; swim the butterfly stroke for 200 yards)	**2** Fill a bag with shells at the seashore	**4** Shovel coal in a furnace	**5.6** Do the butterfly stroke in a championship swim competition at the Olympics
		To perform the task, is it necessary for the person to move their arms or legs?			
	Speed of Limb Movement	Is the speed of the movement important? (e.g., swat a fly; play bongo drums)	**2.5** Saw through a thin piece of wood	**4.5** Swat a fly with a fly swatter	**5.6** Play the bongo drums in a band
	Gross Body Equilibrium	Is it necessary that the person be able to keep or regain his balance to perform the task? (e.g., stand on a ladder; walk across a frozen pond; ride a surf board)	**2** Stand on a ladder	**4.2** Walk on ice across a 25-foot pond	**6** Ride a surfboard when waves average 10 feet
		Does the task require the whole body to be in motion?			
	Gross Body Coordination	Is it necessary and important to coordinate the movement of arms, legs, and torso together? (e.g., move around an obstacle course with no time limit; jump rope without tripping; perform a skilled ballet dance)	**2.4** Get around an obstacle course with no time limit	**4.5** Jump rope for 5 minutes without tripping or stopping	**6.4** Perform a skilled ballet such as Swan Lake

	Ability	Question	Rating Scale Benchmarks		
Gross Motor		Does the task require the person to use a significant amount of physical/muscle strength? (e.g., push, pull, throw, or move an object or one's own body)			
	Static Strength	Is sustained force or muscle strength needed? (e.g., lift a dining room chair; push open a stuck door; lift front end of a V.W.)	**1.5** Lift a dining room chair	**3.2** Push open a stuck door	**6.4** Lift up the front end of a V.W.
	Explosive Strength	Are short bursts of muscle strength needed? (e.g., dive into a pool; drive a golf ball 200 yards; win the Olympic shot-put event; shoot a marble)	**1** Shoot a marble	**4** Drive a golf ball 200 yards	**6.4** Win the shot-put event in the Olympics
		Is this muscle strength used to support the person's body weight?			
		All of his body weight?			
	Dynamic Strength	Using the arms and/or shoulder muscles? (e.g., do 25 push-ups; perform on the rings)	**1.4** Squeeze fresh oranges to make orange juice	**4.5** Do 25 push-ups	**6.8** Win the rings events in the U.S. gymnastic finals
	Trunk Strength	Is the support provided by the stomach and/or lower back muscles? (e.g., sit up in a reclining chair; do 100 sit-ups; lie on back and raise legs off the ground)	**2.2** Sit up in a reclining chair	**5.4** While lying on one's back, raise the legs off the floor for 5 seconds and repeat 10 times	**6.5** Do 100 sit-ups

	Ability	Question	Rating Scale Benchmarks		
	Stamina	Does the task require the person to exert himself physically over a long period of time without getting winded? (e.g., mow a small yard; swim 100 yards; jog 3 miles; bicycle 20 miles; walk around the block)	**1.2** Walk around the block	**2.5** Mow a small yard	**6.2** Bicycle 20 miles to work

INTENTIONALLY LEFT BLANK.

List of Symbols, Abbreviations, and Acronyms

ARL	Army Research Laboratory
CSV	comma-separated value
IMPRINT	Improved Performance Research Integration Tool
JASS	Job Assessment Software System
JCAT	Job Comparison and Analysis Tool
SME	subject matter expert
WIN-T	Army's Warfighter Information Network – Tactical

1 (PDF) DEFENSE TECHNICAL INFORMATION CTR DTIC OCA

2 (PDF) DIR ARL
RDRL DCM
IMAL HRA RECORDS MGMT
RDRL DCL
TECH LIB

1 (PDF) GOVT PRINTG OFC
A MALHOTRA

1 (PDF) ARL – HRED
RDRL HRB B
T DAVIS
BLDG 5400 RM C242
REDSTONE ARSENAL AL
35898-7290

1 (PDF) ARL – HRED
RDRL HRB A
R SPENCER
BLDG E2929
DESERT STORM DR
FORT BRAGG NC
28310-0001

8 (PDF) ARL – HRED
SFC PAUL RAY SMITH CTR
RDRL HRO COL H BUHL
RDRL HRF J CHEN
RDRL HRA I MARTINEZ
RDRL HRR R SOTTILARE
RDRL HRA C A RODRIGUEZ
RDRL HRA B G GOODWIN
RDRL HRA A C METEVIER
RDRL HRA D B PETTIT
12423 RESEARCH PARKWAY
ORLANDO FL 32826

1 (PDF) USA ARMY G1
DAPE HSI B KNAPP
300 ARMY PENTAGON
RM 2C489
WASHINGTON DC 20310-0300

1 (PDF) USAF 711 HPW
711 HPW/RH K GEISS
2698 G ST BLDG 190
WRIGHT PATTERSON AFB OH
45433-7604

1 (PDF) USN ONR
ONR CODE 341 J TANGNEY
875 N RANDOLPH STREET
BLDG 87
ARLINGTON VA 22203-1986

1 (PDF) USA NSRDEC
RDNS D D TAMILIO
10 GENERAL GREENE AVE
NATICK MA 01760-2642

1 (PDF) OSD OUSD ATL
HPT&B B PETRO
4800 MARK CENTER DRIVE
SUITE 17E08
ALEXANDRIA VA 22350

ABERDEEN PROVING GROUND

12 (PDF) ARL
RDRL HR
J LOCKETT
P FRANASZCZUK
K MCDOWELL
K OIE
RDRL HRA AA
C GARNEAU
RDRL HRB
D HEADLEY
RDRL HRB C
J GRYNOVICKI
RDRL HRB D
C PAULILLO
RDRL HRF A
A DECOSTANZA
RDRL HRF B
A EVANS
RDRL HRF C
J GASTON
RDRL HRF D
A MARATHE